



NERVOUS SYSTEM

www.kdhe.state.ks.us/c-f/special_needs_part2.html



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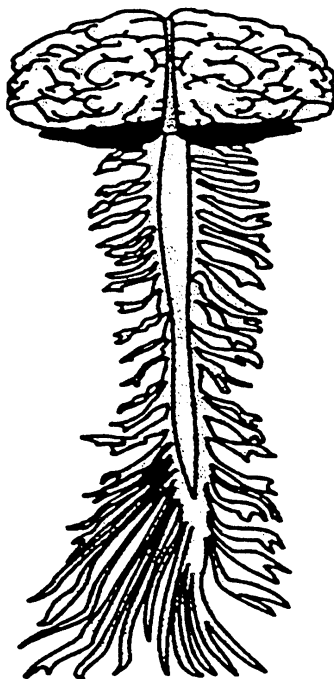
Nervous System

Structure and Function

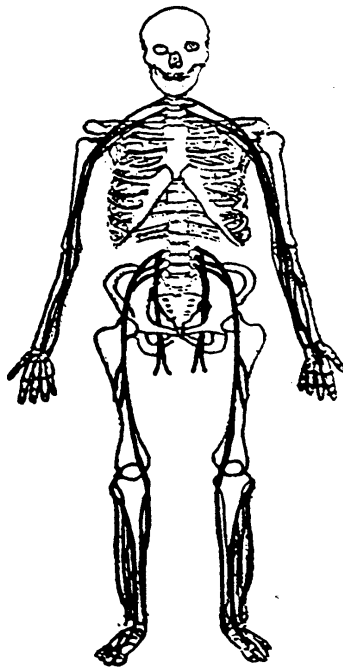
The central nervous system is a tremendously complex structure of brain, spinal cord and nerves. The mechanism of nerve conduction consists of three basic phases: 1) excitation, 2) conduction, and 3) integration. Integration results in a response by a particular gland or muscle in the body. The conduction pathways, or nerves, pass to and from the spinal cord and brain. Nerves are composed of fibers that are extensions of nerve cells in the spinal cord, brain or masses outside away from the cord or brain.

The brain is a highly developed center that serves to integrate messages received from the environment, both external and internal. Some of these messages are handled automatically by centers in the spinal cord as reflexes, and never reach the brain for decision. While thinking is a major function of the brain, other brain functions include (maintenance of) muscle tone, thyroid secretion, liver activity, kidney function and numerous other actions influencing one's overall organ functions.

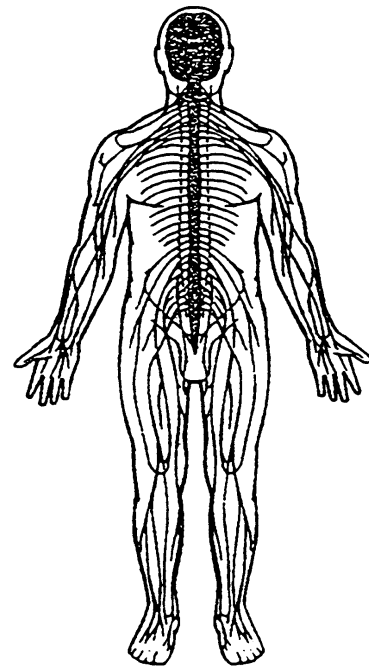
**Diagram of the Central
Nervous System**



**Front View:
Peripheral Nervous System**



**Back View:
Peripheral Nervous System**



SEIZURE DISORDERS

I. Definition

To understand epilepsy, it is necessary to understand the differences between seizures and epilepsy. Seizures occur with epilepsy. Not all seizures are epilepsy. The more generic terminology is seizure.

A seizure is a discrete event in which there is a temporary change in behavior resulting from a sudden, abnormal burst of electrical activity in the brain. This change in electrical activity may be limited to one area of the brain or may begin in one area and spread to other areas of the brain. If the electrical disturbance is limited to only part of the brain, then the result is a partial seizure. For example, the student may experience stiffening or jerking of one arm or leg. If the electrical disturbance affects the entire brain, the result is a generalized seizure.

Epilepsy is a chronic disorder that is characterized by recurrent, unprovoked seizures. Many students with epilepsy have more than one seizure type and may have other symptoms as well.

II. Classification of Seizures

Type of Seizure	Clinical Manifestations
Generalized Seizures	
Tonic/clonic seizures (grand mal seizures or epilepsy) Onset: any age	<i>Before the seizure the student may have an aura or warning that the seizure is about to begin, but often there is no warning. The eyes roll upward, the student loses consciousness, falls to the ground, becomes rigid as muscles tighten (tonic phase). This is followed by jerking movements of the entire body as muscles undergo rhythmic tightening and relaxation (clonic phase). During this phase, the student may lose stool and urine as his/her muscles contract and relax. Entire seizure usually lasts less than 5 minutes. The jerking movements are followed by a drowsiness or deep sleep that may last up to 2 hours.</i>

Petit mal seizures
(absence seizure or "staring spells")
Onset: between 4 and 15 years

These seizures can be mistaken for daydreaming or inattentiveness. Student may:

- *simply stare blankly for 5 - 10 seconds*
- *drop objects because of loss of muscle tone*
- *may have minor movements such as lip smacking,*
- *experience twitching or slight hand movements*

Student will be unable to recall what happened during these brief periods of "blankness". If untreated, seizures can occur many times a day.

This type of seizure is sometimes difficult to differentiate from complex partial seizures. Correct diagnosis is important so that appropriate medication is prescribed.

Partial Seizures

Focal seizures
(simple partial seizures)

Student's eyes or eyes and head turn to one side and the arm on that side may be extended with the fingers clenched. The student appears to be looking toward the closed fist. The student will remain conscious or unconscious during this movement.

Psychomotor seizure
(Complex partial seizures)
Onset: 3 years to adolescence

The student may experience an aura. Most commonly, the aura is described as a strange feeling in the pit of his/her stomach that rises up to their throat. Often this sensation is accompanied by odd or unpleasant odors or tastes, auditory or visual hallucinations, or feelings of elation or strangeness.
During this time, the student is unaware of his/her environment and unable to respond to the environment.
After the aura, the student may suddenly become limp or stiff, appear dazed, confused and apathetic. The most obvious behaviors may be lip smacking, chewing, drooling, swallowing, and nausea and abdominal pain followed by stiffness, a fall, and sleep. The seizure usually lasts 5 to 15 minutes.

Minor Motor Seizures

A group of seizures with the following features:
Myoclonus (sudden, isolated involuntary jerks of muscles)
Frequently associated with mental retardation. Difficult to control.

Epilepsy can be classified by age or the International League Against Epilepsy (ILAE) scheme. Classification by age is determined by the age of the onset of epilepsy. These classes include newborns, infants and young children, school age children, and juveniles (older children and adolescents).

The ILAE scheme classifies epilepsy according to two criteria. The first criteria is whether the predominant seizure type is generalized or localization-related. The second criteria is whether the brain is normal or whether there is evidence of cerebral abnormality.

III. Treatment

Many students with a history of seizures attend a regular classroom and participate in regular school activities, with modifications that should be familiar with the student's lawful custodian, physician, school health nurse and school staff. Staff having contact with the student should be familiar with the student's medications and potential side effects. The school staff should also be able to recognize signs of seizure related behavior and what to do when signs are observed.

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A. Pharmacologic Therapy

The following table summarizes the medications used with epilepsy:

Generic Name	Trade Name	Seizure Type	Side Effects
Carbamazepine	Tegretol	Secondary tonic-clonic Complex partial Simple partial	Lethargy, dizziness, ataxia (muscle) incoordination, behavioral changes, blurred or double vision, aplastic anemia
Clonazepam	Klonopin	Lenox-Gestaut (petit mal variant) Akinetic Myoclonic	Drowsiness, slurred speech, double vision, behavior changes, increased salivation
Valproate	Depakote Depakene	Myoclonic Tonic-Clonic Mixed seizure types	Hair loss, tremor, elevated liver enzymes, irregular menses, increased appetite, nausea and vomiting
Ethosuximide	Zarontin	Petit Mal Myoclonic	GI upset, loss of appetite, headache, lethargy, behavior changes, dizziness
Phenobarbital	Luminal	Tonic-Clonic	Changes in sleep pattern, drowsiness, excitability, irritability, cognitive impairment
Phenytoin	Dilantin	Tonic-Clonic Complex Partial Simple Partial	Nystagmus ("jumpy" eyes), blurred or double vision, gingival hyperplasia, ataxia, skin rash, folate deficiency
Primidone	Mysoline	Tonic-Clonic Complex Partial Simple Partial	Drowsiness, hyperactivity in children, ataxia, behavior changes

B. Diet Therapy

In specific cases, students with seizures may be prescribed a ketogenic diet for treatment and control of seizures. Usually this diet is prescribed for students with poorly controlled seizures who cannot tolerate the side effects of anticonvulsants and/or who have had no success with traditional methods of seizure management.

The ketogenic diet is designed to induce and maintain a state of ketosis which has been found to metabolically improve seizure control in certain cases. The diet is high in fat (80-90%) and low in carbohydrates. It is a carefully calculated diet and requires daily monitoring to maintain ketosis. A student on a ketogenic diet should be followed by a registered dietitian and would have a prescribed meal plan to follow daily. Coordination between the student's neurologist, dietitian, lawful custodian, and school is recommended for the development of a successful health care plan.

C. Monitoring

The purpose of seizure monitoring is to protect the student from injury during a seizure, to carefully observe the seizure in order to provide information for the management of the seizure disorder; and to distinguish between behaviors related to a seizure and those behaviors not related to it. See the following procedure on what to do before and after a seizure.

Monitoring provides the health care provider with the information needed to better manage the student's medication. An increase in the number of seizures may indicate that the student needs a change in medication or that he/she is not receiving the prescribed medication. A change in medication may be needed because of a change in the student's metabolism. In addition, anticonvulsant medication dosage or time can be toxic. Therefore, any side effects from the medication should be documented and reported to the lawful custodian and/or physician. Careful monitoring of the student can improve the management of seizures.

D. Signs of an Emergency

A series of consecutive seizures in which the student does not regain consciousness is called *status epilepticus*, which is a medical emergency. Immediate medical care is required. Seizures which last longer than 15 minutes require hospitalization. Seizures lasting longer than 30 minutes can cause brain damage. Status epilepticus can lead to respiratory failure and death. Therefore, it is critical that the student receive immediate medical attention.

E. Managing A Seizure

Managing a seizure in school consists of protecting the student, observing the student, and getting medical assistance when needed. The following procedures are guidelines for managing a student having a seizure and what to do after the student has a seizure.

IV. Individualized Health Care Plan: Issues for Special Consideration

Each student's Individualized Health Care Plan must be tailored to the individual's needs. The above sections cover the treatment, management issues and symptoms indicating an emergency.

A sample of the Individualized Health Care Plan and Anticipated Health Crisis Plan are found in Appendix A. These may be copied and used to develop a plan for each student. Especially important to include in the Plan is an Anticipated Health Crisis Plan for a student who experiences status epilepticus.

**Seizure Management
Skills Checklist (Grand Mal)**

Student's Name: _____

Person Trained: _____

Position: _____

Instructor: _____

	Demo	Return Demonstration					
	Date	Date	Date	Date	Date	Date	Date
A. States name and purpose of the procedure							
B. Procedure for Grand Mal Seizure:							
1. Remains with student through episode.							
2. Lowers student to floor.							
3. Clears mouth of obstructions.							
4. Provides nothing by mouth.							
5. After seizure, clears mouth of secretions.							
6. Monitors breathing, loss of urine/stool.							
7. Observe for injuries.							
8. Documents activity and duration of seizure, parts of body involved, progression, ability to move after seizure.							

1

Checklist content approved by:

Parent/Lawful Custodian

Date

General Information Sheet

Students with Seizures

Dear (Teacher, Lunch Aide, Bus Driver, etc.):

_____ (student) has a seizure disorder that requires close supervision and observation during and after the episode. Grand Mal seizures usually result in loss of consciousness and sometimes incontinence of urine and/or stool.

Typically, a Grand Mal seizure lasts for less than 5 minutes.

If the student has a Grand Mal seizure, remain with student and contact:

These staff members have been trained to deal with any problems that may arise with this student.

For more information about seizures or the student's needs, consult the school nurse or lawful custodian.

Seizure Management Protocol

Procedure

1. Prepare school environment to be as safe as possible for the student who has a history of seizures.
2. IF THE STUDENT HAS A SEIZURE:
 - Remain calm.
 - An adult must stay with the student during the seizure to monitor his progress.
 - Place student on side or stomach.
 - Do not place anything** in the student's mouth.
 - Loosen tight clothing, especially around the student's neck.
 - If student is standing or sitting, gently lower student to the ground to avoid a fall.
 - Do not give the student any medications or anything to drink during a seizure
 - Document all the student's activity during the seizure:
 - Time the seizure began and ended; area of body where the seizure began; any movement of the seizure from one area of the body to another; kind of movements of the head, face, arms

Points To Remember

Be aware of the potential for head injuries with controlled seizures. The student may require a light-weight helmet for head protection. Prepare for potential problems associated with seizures. For example, if the student has copious secretions with a seizure, a bulb syringe or suction machine will need to be available. Pathways and environments should be free of unnecessary objects. For example, unused toys, wheelchairs, storage boxes, etc. should be removed from the environment.

No one can stop a seizure once it starts.

Prevents tongue from blocking airways and prevents the student from choking on secretions.

Padded tongue blades and airways are NOT recommended because they may induce vomiting and injure the student.

Even if the student is in a wheelchair or other equipment, lower the student to the ground. If possible, place a cushion or blanket under the student's head.

VENTRICULAR SHUNT

I. Purpose

A ventricular shunt is a method of treatment for hydrocephalus. Hydrocephalus is excess fluid in the ventricles of the brain. A ventricular shunt is surgically placed to drain the excess fluid from the brain into another part of the body. A ventriculoperitoneal shunt drains fluid from the ventricles of the brain to the abdomen or peritoneal cavity. A ventriculoatrial shunt drains the excess fluid to the right upper chamber of the heart, which is the right atrium of the heart.

Students who have a shunt need routine monitoring to ensure the proper functioning of the shunt. If the shunt malfunctions, the student with hydrocephalus is at risk for an increase of intracranial pressure and possible brain damage. Shunt malfunctions can only be detected outside the hospital by a change in behavior. Therefore shunt monitoring involves watching for behaviors that may indicate the shunt is not functioning. There is no actual contact by the care provider with the components of the shunt.

II. Suggested Settings

Students with a shunt can attend a regular classroom. Many students with a shunt participate in regular school activities, with modifications that should be determined by the lawful custodian, physician, school health nurse, and school staff. Staff in contact with the student should be able to recognize signs of increased intracranial pressure and know what to do when these signs are observed.

III. Suggested Personnel and Training

Monitoring of a ventricular shunt may be performed by the school nurse, lawful custodian, teacher aide, or other staff person who has general training in monitoring the shunt of the student. General training should cover the student's specific health care needs, potential problems, and how to obtain assistance should problems occur.

The basic skills checklist in Appendix B can be used as a foundation for competency-based training in appropriate techniques. The checklist outlines specific procedures. Once the procedures have been mastered, the completed checklist serves as documentation of training.

IV. Individualized Health Care Plan: Issues for Special Consideration

Each student's Individualized Health Care Plan must be tailored to the individual's needs. The following section covers the procedure for monitoring a ventricular shunt and possible

- After the seizure is over, clear secretions from the student's mouth with a bulb syringe or suction catheter.
4. Monitor student's breathing. *Do not try to clear the student's mouth until the seizure is ended. Outside of mouth, any area may be wiped free of saliva even during seizure.*
5. Talk with student to determine student's level of awareness. *If student is not breathing, activate the emergency medical system and begin CPR.*
6. Determine and document whether or not the student is able to move arms and legs, or if there is change in the student's ability to move. *Note if the student is alert, confused, drowsy, etc. Document.*
7. Check for loss of control of urine and stool, and for any injuries. *Loss of control is very embarrassing to the student. Assist student with personal hygiene as needed. Blood in saliva or around mouth may indicate tongue bite.*
8. Make the student comfortable, allow him/her to sleep as needed. *After the seizure, the student may sleep for 30 minutes up to a number of hours.*
9. Record on student health record the length of seizure, what happened during the seizure.² *Notify the lawful custodian and/or physician.*

problems and emergencies that may arise. It is essential to review the procedure before writing the Individualized Health Care Plan.

A sample of the Individualized Health Care Plan and Anticipated Health Crisis Plan are found in Appendix A. These may be copied and used to develop a plan for each student. For a student who requires monitoring of a ventricular shunt, the following items should receive particular attention:

- The student's underlying condition.
- The student's baseline or normal behaviors.
- History of frequent emergencies.
- Behaviors that indicate there may be a malfunction of the shunt.

V. Possible Problems that Require Immediate Attention

Observations

Signs of increased intracranial pressure: headache, nausea, vomiting, double vision, blurred vision, irritability, restlessness, personality change, lethargy, drowsiness, inability to follow simple commands, decreased orientation to time and place, and seizures.

(Note: In the infant whose soft spot can still be felt, the soft spot becomes full.)

Reason/Action

When a shunt malfunctions, the fluid in the ventricles build up, resulting in increased intracranial pressure (increase pressure in the brain). School personnel who are uncertain of their observations should consult with the lawful custodian and/or school health nurse to determine if a physician should be notified.

*It is **important** that the school staff learn what is normal behavior for the individual student and what behaviors indicate the presence of increased intracranial pressure. Seizures must be monitored by the school staff and treated accordingly. See **Seizures in this manual**.*

If the pressure continues to increase in the ventricles, the student's pupils (the dark area in the center of the eye) may become smaller and react very slowly to light. If the pressure continues to increase, the student's pupils may enlarge and become fixed when exposed to light. The pulse may decrease, breathing may become irregular, and eventually death may occur.

*The physician may determine that the valve of the shunt must be pumped to reduce intracranial pressure. **The risks involved with the pumping of the shunt are great. If too much cerebrospinal fluid is removed, there is a resulting decrease in the amount of pressure in the brain. The ventricles may collapse inward, resulting in additional brain damage. Pumping of a shunt should occur only in a medical setting under direct medical supervision.***

Signs of shunt infection:

- Nausea
- Vomiting
- Headache
- Lethargy
- Feeding problems
- Fever

Any signs of shunt infection should be reported to the school health nurse and/or lawful custodian. A shunt infection requires administration of antibiotics. The shunt may need to be replaced if the infection is not treated successfully.

Monitoring Ventricular Shunt**Procedure**

1. Document weekly observations of the student's:
 - Behavior
 - Level of activity
 - Response to and awareness of the environment
2. Document any signs of shunt malfunction or signs of infection in the school health record or student's log.³

Points to Remember

Using knowledge of the student's usual behavior can help staff discriminate between usual and unusual behavior.

Follow the link below to view signs of infection or shunt malfunction:

<http://www.divideclassic.org/Documents/ShuntInfo.htm>

General Information Sheet

Students With Ventricular Shunts

Dear (Teacher, Lunch Aide, Bus Driver, etc.):

_____(student) has a condition that requires a ventricular shunt. A ventricular shunt is a tube placed in the brain to drain off excess fluid. The shunt is under the skin and is not visible except for a slight bulge.

Most students with ventricular shunts are able to participate in regular school activities. However, if any changes in behavior are noted in the student, please report them to the school nurse or lawful custodian. A blow to the head should be avoided. If this occurs, the student should be observed closely for any changes in behavior.

If the student has any problems with his/her ventricular shunt, contact:

These staff members have been trained to deal with any problems that may arise with this student.

NOTES

1. Information on page 8 of this section adapted from:

Children's Hospital Chronic Illness Program, Ventilator Assisted Care Program. (1987). *Getting it started and keeping it going: A guide for respiratory home care of the ventilator assisted individual*. New Orleans, LA,

2. Information on pages 10-11 of this section adapted from:

Keen, T., et al. *Guidelines for specialized healthcare procedures*. Virginia Department of Health. Richmond.

Graff, J., Ault, M., Guess, D., Taylor, M., and Thompson, B. (1990). Monitoring a Shunt. *Health care for students with disabilities, an illustrated medical guide for the classroom*. Baltimore: Paul H. Brookes Publishing Company. (pp. 159-160).

3. Information on pages 13-15 this of section adapted from:

Graff, J., Ault, M., Guess, D., Taylor, M., and Thompson, B. "Monitoring a shunt." (pp. 159-169).